

Native Bee Benefits

How to increase native bee
pollination on your farm in
several simple steps

For Pennsylvania and New Jersey Farmers



In this pamphlet,
you can find out...

- The most effective native bees in PA and NJ and how to identify them
- Their habitat and foraging needs
- Strategies for encouraging their presence on your farm
- Sources of funding

Why are native bees important?

Insect pollination services are a highly important agricultural input. Two-thirds of crop varieties require animal pollination for production and many crops have higher quality after insect pollination.^{1,2,3} Bees are the most important pollinators in most ecosystems. They facilitate reproduction and improve seed set for half of Pennsylvania's and New Jersey's top fruit and vegetable commodities.^{4,5,6} Estimated value of their pollination services range from \$6 - 263 million each year.⁷

Honeybee numbers in Pennsylvania and New Jersey have been declining over the past several years. Beekeepers recorded overwinter losses of 26- 48% and 17-40% respectively in PA and NJ between 2006 and 2009.^{8,9,10} These losses are much higher than the typical 15% losses seen in previous years.¹⁰ Although many farmers rent managed honeybees to increase crop yield and quality, surveys of small to medium size PA and NJ farms have shown that native bees provide a substantial portion of pollination services.^{11,12} By increasing the number and diversity of native bees, PA and NJ farmers may be able to counter rising costs of rented bee colonies while supporting sustainable native plant and pollinator communities.



Why is insect pollination so important?

Bees can efficiently transfer pollen between *different* plant individuals of the *same* species. This cross pollination makes for healthier and more genetically diverse plant populations. It also helps crops such as watermelon, which have separate pollen providing (male) and fruit producing (female) flowers, or apples, for which many varieties require cross-pollination from a different variety (called "self-incompatibility").

Native Bee Species

you are likely to find on your property.

Black and white images represent actual bee size.



What to look for: Hairy, yellow and black, 0.3-0.6 in. (0.8-1.6 cm)

Bombus impatiens

Common Eastern Bumble Bee

Abundance: Very common

Range: Broadly throughout Eastern US

Season: March –November

Sociality: Eusocial

Typical Flight Distance: 2-4.6 mi. (3.3-7.5 km)

Nesting: Below ground or in existing pockets such as rodent nests, under logs, stone walls. Found in a wide variety of habitats. Up to 400 workers per colony.

Foraging: Broad generalist

Recommended native plants: *Asclepias syriaca*, *Apocynum cannabinum*, *Pycnanthemum tenuifolium*, *Cirsium discolor*

Key crops pollinated: Blueberry, Cranberry, Muskmelon, Squash, Pepper, Tomato, Watermelon

“Eusocial” means the species lives in colonies with a reproductive queen and sterile workers who are her daughters. All bees in the colony communicate and cooperate in caring for the brood.

Bombus fervidus

Golden Northern Bumble Bee

Abundance: Not common

Range: Broadly throughout Eastern US

Season: April-October

Sociality: Eusocial

Typical Flight Distance: 0.9-1.8 mi. (1.4-3 km)

Nesting: Above or below ground in sunny, dry locations, tend to prefer fields. Their nests may be in old rodent nests or may simply resemble field mouse nests.

Foraging: Broad generalist

Recommended native plants: *Asclepias syriaca*, *Apocynum cannabinum*, *Pycnanthemum tenuifolium*, *Cirsium discolor*

Key crops pollinated: Muskmelon, Squash, Pepper, Tomato, Watermelon

“Generalist” bee species visit a large variety of plants and crops, in contrast to “specialist” bee species which forage on a restricted group of plants.



What to look for: Hairy, yellow most of body, 0.4 in. (1 cm) (John Ascher/www.discoverlife.org)

Ceratina calcarata, *C. dupla* and *C. strenua*

Small Carpenter Bees

Abundance: Common

Range: Broadly throughout Eastern US

Season: March-October

Sociality: Solitary

Typical Flight Distance: 22-87 yd. (20-80 m)

Nesting: Chews nest cells in pithy stems, rotten vines or other wood substrate. Found in a wide variety of habitats.

Foraging: Broad generalist

Recommended native plants: *Erigeron strigosus*, *Pycnanthemum tenuifolium*, *Solidago odora*, *Euthamia graminifolia*

Key crops pollinated: Muskmelon

Big bees (like *B. fervidus*) can typically fly farther than small bees (like *Ceratina*). The cartoon insets within the images show the real size of the bee.



What to look for: Hairless, dark metallic brown to black, 0.2-0.3 in. (0.5-0.8 cm)

Habropoda laboriosa

Southeastern Blueberry Bee

Abundance: Common

Range: East coast of US

Season: May

Sociality: Solitary

Typical Flight Distance: 1-2.3 mi. (1.7-3.7 km)

Nesting: Burrows in dry, sandy soils singly or in groups. Found in low-lying coastal habitat.

Foraging: Specialist

Recommended native plants: N/A

Key crops pollinated: Blueberry

In “solitary” bee species, every female lays eggs and there are no queens or workers. Each female usually builds and inhabits her own nest.



What to look for: Hairy yellow shoulders, black body, 0.6 in. (1.5 cm) (Jerry Payne/USDA ARS)



Augochlora pura and *Augochlorella aurata* Blue-Green Sweat Bees

Abundance: Common

Range: Broadly throughout US

Season: April-October

Sociality: Eusocial (*Augochlorella striata*) and Solitary (*Augochlora pura*)

Typical Flight Distance: 66-230 yd. (60-210 m)

Nesting: Soil burrowing in well-drained areas, found in a wide variety of habitats (*Augochlorella striata*). Burrows into rotting wood (e.g. logs, stumps) (*Augochlora pura*).

Foraging: Broad generalist

Recommended native plants: *Apocynum cannabinum*, *Erigeron strigosus*, *Pycnanthemum tenuifolium*, *Solidago odora*, *Euthamia graminifolia*

Key crops pollinated: Muskmelon, Pepper, Strawberry, Tomato, Watermelon

What to look for: Hairless, metallic blue to green, 0.2-0.3 in (0.5-0.8 cm) (*Augochlora pura*, left; *Augochlorella aurata*, right)



Lasioglossum (Dialictus) Dark Sweat Bee

Abundance: Very common

Range: Throughout eastern US

Season: April-October

Sociality: Eusocial/Rarely solitary

Typical Flight Distance: 11-450 yd. (10-410 m)

Nesting: Soil burrowing in well-drained areas. Found in a wide variety of habitats.

Foraging: Broad generalist

Native plant use: *Apocynum cannabinum*, *Erigeron strigosus*, *Pycnanthemum tenuifolium*, *Solidago odora*, *Euthamia graminifolia*

Key crops pollinated: Muskmelon, Pepper, Tomato, Watermelon

What to look for: Short, fine hairs, dark brown to black metallic color, 0.2 in. (0.5 cm) (Karl Volkman/ www.bugguide.net)

Lasioglossum is a diverse genus of bees found all over the world. Many species of the sub-genus *Dialictus* are likely active on your property.

Halictus confusus

Abundance: Common

Range: Throughout the US, Canada and Europe

Season: April-October

Sociality: Eusocial

Typical Flight Distance: 75-140 yd. (70-130 m)

Nesting: Soil burrowing in well-drained areas. Found in a wide variety of habitats.

Foraging: Broad generalist

Recommended native plants: *Apocynum cannabinum*, *Erigeron strigosus*, *Pycnanthemum tenuifolium*, *Solidago odora*, *Euthamia graminifolia*

Key crops pollinated: Pepper, Strawberry, Tomato, Watermelon



What to look for: Short, fine hairs, light/dark brown stripes with some metallic copper, 0.3 in. (0.7 cm)

Peponapis pruinosa Squash Bee

Abundance: Not common

Range: Throughout US, concentrated on east coast

Season: July-September

Sociality: Solitary

Typical Flight Distance: 0.5-1 mi. (0.8-1.7 km)

Nesting: Soil burrowing in well-drained areas, found wherever there is squash (even urban gardens); sometimes will lay eggs in nests of other bees

Foraging: Specialist

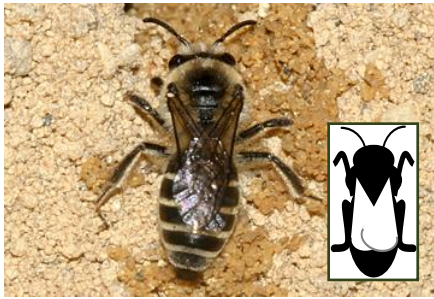
Recommended native plants: N/A

Key crops pollinated: Squash

P. pruinosa is an example of an "oligolectic" bee, or an extreme specialist. It only forages on a single type of plant, squash, the reason for its common name.



What to look for: Hairy yellow shoulders, black and gray stripes, 0.5-0.6 in. (1.2-1.4 cm) (Sue Orrell/ www.pbbase.com)



Colletes inaequalis Plasterer Bee

Abundance: Common
Range: Throughout eastern US
Season: March-June
Sociality: Solitary
Typical Flight Distance: 0.5-1.2 mi. (0.9-2 km)
Nesting: Soil burrowing, found in large aggregations in grassy areas with inorganic soil
Foraging: Broad generalist
Recommended native plants: N/A
Key crops pollinated: Apple

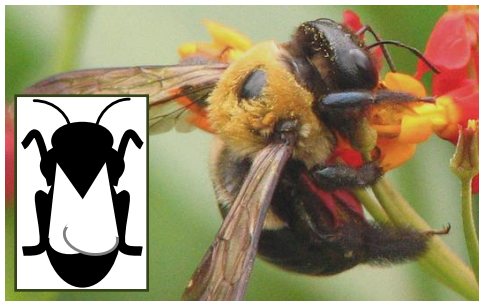
What to look for: Hairy yellow face and shoulders, light and dark brown stripes, 0.8 in. (1.3 cm) (Tom Murray/ www.bugguide.net)



Andrena carlini, *A. dunningi*, *A. crataegi*, *A. regularis*, *A. carolina*, *A. milwaukeensis*, *A. vicina*

Abundance: Not common
Range: Worldwide
Season: March-July
Sociality: Solitary
Typical Flight Distance: 140-930 yd. (130-850 m)
Nesting: Soil burrowing, sometimes found in forests or bogs
Foraging: Generalist/sometimes specialist
Recommended native plants: *Apocynum cannabinum*; Rosaceae, Brassicaceae, and Ericaceae families; *Aruncus*, *Ilex*, and *Viburnum* sp.
Key crops pollinated: Apple, Blueberry, Strawberry

What to look for: Hairy yellow shoulders, black or dark/reddish brown body, 0.4-0.6 in. (1.0-1.4 cm) (*Andrena vicina*/www.bugguide.net)



Xylocopa virginica Eastern Carpenter Bee

Abundance: Very common
Range: Throughout eastern US
Season: March-October
Sociality: Solitary
Typical Flight Distance: 5.5-13 mi. (8.8-21 km)
Nesting: Look for 0.5 in. circular holes in any wood (seem to prefer soft wood such as pine). Found in a wide variety of habitats, thrives even in cities and suburbs.
Foraging: Broad generalist
Recommended native plants: *Asclepias syriaca*, *Solidago odora*, *Pycnanthemum tenuifolium*, *Euthamia graminifolia*, *Cirsium discolor*
Key crops pollinated: Blueberry

What to look for: Hairy yellow shoulders, black body, 1 in. (2.3 cm) (Athena Anderson/ www.discoverlife.org)

Although carpenter bees are often considered pests, they are effective pollinators. Their nesting rarely impacts wood's structural integrity, but providing them with other sources of wood may keep them from nesting in or near your home.

Apis mellifera European Honeybee

Abundance: Common
Range: Worldwide
Season: March-November
Sociality: Eusocial
Typical Flight Distance: 0.4-0.8 mi. (0.6-1.3 km)
Nesting: Only lives in managed hive boxes
Foraging: Broad generalist
Recommended native plants: *Apocynum cannabinum*, *Pycnanthemum tenuifolium*, *Euthamia graminifolia*
Key crops pollinated: Apple, Blueberry, Cranberry, Cucumber, Muskmelon, Squash, Strawberry, Watermelon

Honeybees are not native to North America, but they are important crop pollinators in PA and NJ as well as throughout the world. Efforts to support native bees may help stabilize honeybee populations.



What to look for: Densely hairy shoulders, distinct 'cinnamon' color with light and dark brown stripes, 0.6-0.75 in. (1.5-1.9 cm)

The most efficient native bees for top regional fruits and vegetables.^{12,13}

All these bees are good pollinators, but three stars (***) indicates a key pollinator for that crop. Supporting a variety of bee species will help maintain reliable pollination of crops season after season. A good goal would be to attract as diverse a collection of bees as possible.

Bee Species	Crops	Apple	Blueberry	Cranberry	Cucumber	Muskmelon	Pepper	Squash	Strawberry	Tomato	Watermelon
<i>Andrena</i> (multiple species)		*	**						*		
<i>Augochlora pura</i>						***	**			**	**
<i>Augochlorella striata</i>						***	**		*	**	**
<i>Bombus</i> (multiple species)			*	*		***	*	**		**	***
<i>Bombus impatiens</i>			*	**	**	***	*	**		**	***
<i>Ceratina</i> (multiple species)						*					
<i>Colletes inaequalis</i>		*	**								
<i>Habropoda laboriosa</i>			***								
<i>Halictus confusus</i>							***		*	**	**
<i>Lasioglossum (Dialictus)</i>			*			**	***		**	***	***
<i>Peponapis pruinosa</i>						*		***			*
<i>Xylocopa virginica</i>			**								

Bee importance
for crop
pollination

* **Good**

** **Better**

*** **Best**

How do I attract these bees to my farm?

There are two key things that would likely increase support for native bees on PA and NJ farmland:

- Grow recommended native plants that studies have shown are preferred by bees in order to attract more pollinators to your property (see page 6).
- Establish areas of suitable pollinator habitat around the farm. This will allow more bees to nest on your property and encourage their return year after year (see page 7).

The rest of this pamphlet provides guidelines for what you can do to make your farm a bee haven.



Foraging Needs

Bees feed on nectar and pollen, which come exclusively from flowers. Plant a variety of flowers that will provide bee foraging resources throughout the growing season. This will ensure that at any given time at least some flowers are in bloom and that you will attract a diversity of pollinators. These plants must be close to bee nesting sites (within a bee's flight range, shown on pages 2-4) and sufficiently abundant to support both large and small bees. Larger bees have longer flight distances and so can fly farther to reach food. They also require greater amounts of food (more flowers). Cultivating large clumps of recommended native flowers (shown below) in various areas around your farm will be more effective for attracting bees than growing them all in one spot. Plants with more stars (***) are more preferred by the indicated visiting bees.¹⁴

[†] The USDA-NRCS PLANTS database lists *Cirsium discolor*, a native field thistle, as potentially weedy or invasive. Though you should not encourage large populations, it is a valuable pollinator foraging resource and can be managed as such. Its seeds are not commercially available.



Plant Scientific Name	Plant Common Name (Perennial, Annual)	Visiting Bees	Bee Preference	Flowering Season					
				April	May	June	July	Aug	Sept
1. <i>Cirsium discolor</i> [†]	Field thistle (P)	Ap, B, X	**						
2. <i>Erigeron strigosus</i>	Daisy fleabane (A)	Ap, Au, C, H, L	*						
3. <i>Scutellaria integrifolia</i>	Helmet flower (P)	B	***						
4. <i>Apocynum cannabinum</i>	Indianhemp (P)	An, Ap, Au, B, L	**						
5. <i>Prunella vulgaris</i>	Common selfheal (P)	Ap, Au, B, L	**						
6. <i>Verbena hastata</i>	Swamp verbena (P)	C	***						
7. <i>Asclepias syriaca</i>	Common milkweed (P)	Ap, B, X	***						
8. <i>Euthamia graminifolia</i>	Flat-top goldentop (P)	Ap, Au, C, H, L, X	**						
9. <i>Lobelia spicata</i>	Palespike lobelia (P)	B, C	***						
10. <i>Agalinis purpurea</i>	False foxglove (A)	Au	***						
11. <i>Pycnanthemum tenuifolium</i>	Narrowleaf mountainmint (P)	Ap, Au, B, C, H, L	**						
12. <i>Solidago odora</i>	Aniscented goldenrod (P)	Ap, Au, C, H, L, X	**						
13. <i>Potentilla norvegica</i>	Norwegian cinquefoil (A/P)	Au, H, L	***						
14. <i>Eupatorium maculatum</i>	Spotted joe pye weed (P)	B, C, H	***						
15. <i>Vernonia noveboracensis</i>	Broadleaf ironweed (P)	Au, C, H, L	***						

Visiting Bees Key:

An= Andrena
Ap= Apis
Au= Augochlora/Augochlorella
B= Bombus
C= Ceratina
H= Halictus
L= Lasioglossum
X= Xylocopa



Nesting Needs

There are three common bee nesting strategies, those of ground nesting bees, wood nesting bees and bumble bees.

Ground nesting bees require direct access to soil in well-drained, sunny areas (see image 4, right). Look for small, very circular holes in the ground surrounded by piles of displaced dirt.

Wood nesting bees are found in pithy twig or vine centers, rotting wood, and existing cavities in wood. Only carpenter bees chew their own nest cells into soft wood substrates; others require existing holes.

Bumble bees are more generalist in their nesting habits (image 3, right, shows them nesting in a compost pile) and can be found under leaves, in old rodent dens and other preexisting cavities, above or below ground.

For more information, see the Xerces Organization's factsheets at www.xerces.org/wp-content/uploads/2008/10/agroforestrynotes34-bee_nests.pdf.



1. Weedy area good for bee nesting



2. Wood-nesting bee nest cells



3. Bumble bees nesting in compost



4. Ground-nesting entrance hole

Nest Type	Nesting Needs	What You Can Do
Ground nesting	<ul style="list-style-type: none"> Direct access to soil surface Sunny, well-drained areas with no/sparse vegetation Sloped ground 	<ul style="list-style-type: none"> Leave sunny, well-drained, south-facing sloped ground undisturbed. Tilling the soil will destroy any ground nests. Clear most vegetation in these areas (leave some grasses to prevent erosion).
Wood nesting	<ul style="list-style-type: none"> Twigs and vines with pithy centers Existing holes in wood from other insects Rotting logs and stumps Tree snags 	<ul style="list-style-type: none"> Leave dead wood in appropriate areas near recommended flowering plants. Increase plants with pithy stems (elderberry, boxelder, raspberry, dogwood, etc.) in areas near crops and native foraging resources. Cut back annually to allow bee access to pithy centers. Build a nest: Tie 10-20 hollow stems or paper straws with one end closed (6-8" long) together into a bundle and place in a protected area about 4' off the ground. Bamboo and reeds are good materials (see image 2 above). Put them out in early spring. Make sure foraging resources are nearby. Build a nest: Drill small holes of diameters ranging from 3/32" to 5/16" and 3" to 6" deep into natural or man-made wood structures (logs, boards, dead wood, stumps, etc.). Drill sloping very slightly upward to reduce water entry into holes.
Bumble bees	<ul style="list-style-type: none"> Small preexisting cavities in wood or other material Rodent burrows Fallen leaves or other plant matter Grassy areas, meadows 	<ul style="list-style-type: none"> Minimize mowing in grassy meadows or thickets (see image 1). If mowing is necessary, reduce to once every 3-5 years and only in late fall. Avoid removing excessive amounts of weeds in these areas. Do not exterminate rodents or destroy their nests. Leave potential nesting sites protected (unmowed, untilled) during winter for dormant queens.

What funding sources are available for a bee habitat restoration project on my property?

In order to fund habitat preservation efforts, farmers can tap into resources that have recently been made available by the Food, Conservation and Energy Act of 2008 (otherwise known as the Farm Bill).

Over the next five years \$100 million will be devoted to pollinator habitat research and conservation through such state-level initiatives as the Conservation Stewardship Program, the Wildlife Habitat Incentives Program and the Environmental Quality Incentives Program.¹⁵

Through these programs farmers could receive annual compensation for investment in pollinator habitat ranging from 75-100% of total costs and foregone income.¹⁶ For more information, see page 8 which details the availability of funds in Pennsylvania and New Jersey and whom to contact.



Pollinator Habitat Funding Opportunities for Individual Farmers

Program	Mission	Agency	Funding	Priorities	Contract Length	Eligibility and Contact Info.
Conservation Reserve Program (CRP)	Land retirement program, protects environmentally sensitive land	PA and NJ Farm Service Agency (FSA)	Cost-sharing for 50% of eligible conservation practices, rental payments for long-term conservation	<ul style="list-style-type: none"> Wildlife habitat benefits Pollinators are high priority wildlife (under practice CP38)¹⁶ 	10-15 years	http://www.fsa.usda.gov/FSA/webapp?area=home&subject=copr&topic=crp Contact your local USDA Farm Service Agency office to apply
Environmental Quality Initiatives Program (EQIP)	Addresses resource concerns to improve environmental quality	PA and NJ Natural Resources Cons. Service (NRCS)	45-75% of typical costs of implementing the practice	<ul style="list-style-type: none"> At-risk species habitat conservation Preservation and management of grasslands for pollinators 	1-10 years (priority given to 1-3 year projects)	NJ: www.nj.nrcs.usda.gov/programs/eqip PA: www.pa.nrcs.usda.gov/programs/eqip/ PA Incentives Manager: Ed Sanders, 717-237-2201
Wildlife Habitat Incentives Program (WHIP)	Promotes restoration of important wildlife habitats	PA and NJ NRCS	60-75% of typical cost of implementing the practice	<ul style="list-style-type: none"> In NJ, pollinator habitat a top priority for 2009 Habitat development and management component encouraged 	1-10 years (work usually completed 1-3 years)	NJ: www.nj.nrcs.usda.gov/programs/whip/ PA: www.pa.nrcs.usda.gov/programs/whip/ Ed Sanders, 717-237-2201

Applications are available at any USDA Service Center, or you can request them to be sent to you by calling your local USDA Service Center.

Note: The NJ Conservation Security Program (not mentioned above) may soon include pollinator conservation language due to the 2008 Farm Bill (www.nj.nrcs.usda.gov/programs/csp).

For more technical or logistical information on funding, growing recommendations for native plants and pollinator habitat restoration, visit the Natural Resources Conservation Service website (www.nrcs.usda.gov) and contact your local NRCS office.

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Images

Pg 6: Elaine Haug @ USDA-NRCS PLANTS Database (*Lobelia spicata*, *Asclepias syriaca*, *Pycnanthemum tenuifolium*)
 Patrick J. Alexander @ USDA-NRCS PLANTS Database (*Apocynum cannabinum*)
 Jeff McMillian @ USDA-NRCS PLANTS Database (*Erigeron strigosus*, *Prunella vulgaris*)
 Jim Stasz @ USDA-NRCS PLANTS Database (*Scutellaria integrifolia*, *Verbena hastata*)
 Seabrooke Leckie (*Solidago odora*)
 Thomas Barnes (University of Kentucky) @ USDA-NRCS PLANTS (*Agalinis purpurea*, *Cirsium discolor*)
 William Justice @ Connecticut Botanical Society (*Eupatorium maculatum*)
 Janet Novak @ Connecticut Botanical Society (*Eupatorium maculatum*)
 Robert H. Mohlenbrock @ USDA-NRCS PLANTS Database (*Euthamia graminifolia*)
 www.botanik.uni-karlsruhe.de/garten/fotos-hassler/ (*Potentilla norvegica*)
Pg 7: (Clockwise from top right), Rufus Isaacs (Michigan State University, Conserving Native Bees), Dennis L. Briggs @ VernalPools.org, Gillian Perry @ flickr.com,

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